

RANSOHOFF (JOS.)

Concerning Stone in the Kidney  
and its Operative Treatment,  
with Report of Cases.

CHAIRMAN'S ADDRESS.

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*presented by the author*

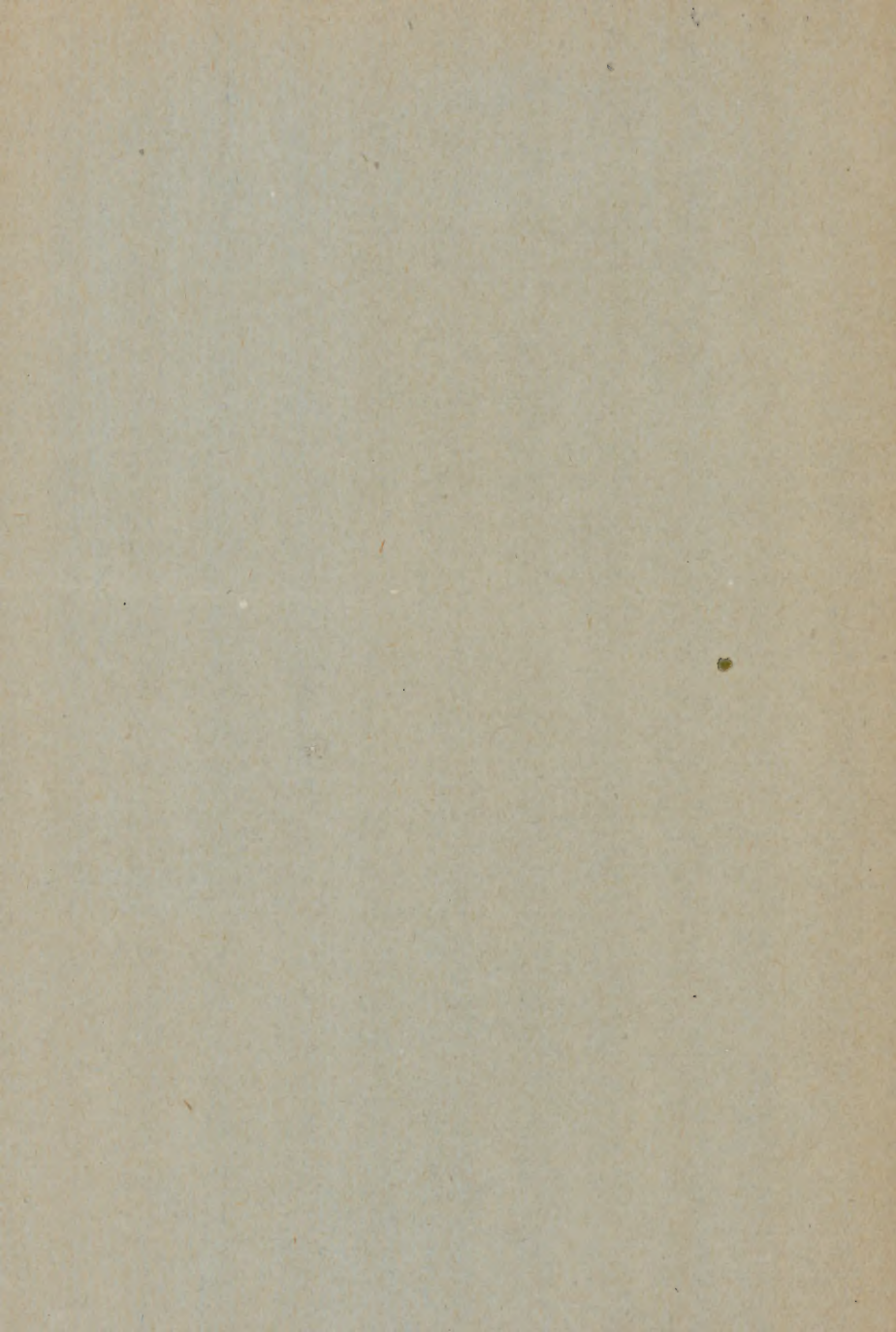
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The first, the easy, the pleasant part of my task, is to express my appreciation of the honor of being permitted to preside over your deliberations. The distinction is not lessened by the surgical achievements, past and present, of the city in which we are convened. It was in Baltimore that the common iliac artery was first tied by William Gibson before he was called to shed luster on the surgery of Philadelphia. It was here that Jameson first in the history of surgery made a nearly complete excision of the upper jaw. It was here that the son, worthy of a worthy father, Nathan Rhyno Smith, for nearly half a century fostered surgical growth. His surgical anatomy of the arteries did much toward elevating American surgery of the second quarter of the century to the high plane then occupied by that of France and of England. For a simple and efficient method of suspending an extremity are we likewise indebted to this Nestor among American surgeons. The mantles of such worthy peers have not been laid aside; they are worn with dignity and grace by younger scions. *Nomina sunt odiosa*. Great as were the early surgeons of Baltimore, they did not venture, like those of to-day, to remove the Gasserian ganglion, lay bladder, ureter and kidney open to inspection, and last but not least, extend the hope of all



but absolute relief to the woman with cancer of the breast.

The rule of the ASSOCIATION calling for an annual address on surgery, fortunately relieves the Chairman of your Section of the burden of presenting in formal review the progress made. It gives him the option to limit his remarks to a single topic of surgical interest. Of this privilege I beg to avail myself, the subject of my choice being, "Concerning stone in the kidney and its operative treatment."

Clearness in the diagnosis and skill in the operative treatment of surgical diseases of the kidney are among the latest, though not the least, of the conquests of the closing decades of our century. Thorough chemic, microscopic and bacteriologic examination of the urine, cystoscopy, catheterization of the ureters, and probatory incisions, have done much to bring affections of these organs within the range of diagnostic certainty. The relative values of symptoms are becoming fixed, and in the operative technique many questions are definitely settled and more are fast nearing solution. Yet there are not a few problems pertaining to renal surgery which collective statistics alone can solve, since from the comparative rarity of the affection the experience of the individual must be greatly restricted. Such problems pertain to the diagnosis and treatment of primary stone in the kidney. To more clearly elucidate the questions to be submitted for consideration, I beg to present the following seven cases in which the kidney was explored for stone:

*Case 1.*—M. L., age, 27, seen with Drs. Phelps and Comegys. A robust young man under treatment for gonorrhea, for which the balsamic oils had been freely administered. Has had repeated sharp attacks of pain in the back and the left groin, but never required treatment for them. On April 1, 1892, he was seized with violent pain in the left side, radiating to the testicle. Micturition frequent. The urine was of high specific gravity and contained a large amount of blood. Three days after the inception of the attack there was a severe rigor, followed by febrile elevations of temperature of from 2 to 3 degrees, which continued until April 22. The symp-

toms were referred to the bladder. Dysuria was the marked subjective symptom. The quantity of urine was greatly reduced, until the quantity passed in twenty-four hours was between six and eight ounces. The patient had become irresponsive and somnolent. The tongue was dry. The urine secreted had to be removed by catheterization. Bimanual examination of the left lumbar region showed increased resistance. On deep inspiration a very decided enlargement of the left kidney, could be detected. The examination elicited pain in the region of the kidney, radiating toward the bladder. Diagnosis: pyelitis and oliguria, probably of calculus origin.

Operation, April 22; chloroform narcosis; incision of the costo-iliac interval parallel to the last rib and exposure of kidney. The organ was apparently twice its normal size, of a dark purplish color. Exploratory aspiration revealed pus. Incision through the posterior wall of the kidney substance into the pelvis gave vent to about two ounces of foul pus. In the lower end of the pelvis a small oxalate of lime calculus was found impacted; weight eight grains. The cavity of the kidney was thoroughly irrigated with sterilized water, drainage tube inserted and wound partly packed. With the relief of intra-renal tension afforded by the operation, both kidneys resumed their function; the urine passed by the bladder and through the wound was, as near as could be estimated, about equal in quantity. The temperature subsided to the normal within a week, and it looked, during the first week after the operation, as though the patient would make an uninterrupted recovery. Without discernible cause a rigor supervened on May 23. It was followed by a train of uremic symptoms identical with those of his first seizure. The urine ceased altogether to flow *per vias naturales*, and the quantity discharged from the fistula of the left side was reduced to from six to eight ounces in the twenty-four hours. On May 26 four ounces were passed from the wound. From that time to May 28 the condition of total anuria existed. Pain was complained of in the right lumbar region and palpation revealed a slight enlargement of the kidney.

May 29, 37 days after the first operation, nephrotomy was made on the right side. About one ounce of fetid pus was removed, but prolonged and careful exploration of the pelvis and ureter failed to reveal the presence of a calculus. The wound was treated as in the first instance by drainage. Within twenty-four hours the patient *quoad vitam* was on the road to recovery. The left kidney at once resumed its function and during the three years which have passed has performed three-fourths of the work of both glands. The right kidney has never resumed its full functional activity. It is easy to estimate the excreting capacity of the two glands, since the patient has a renal fistula on each side, for the relief



of which he will allow no effort to be made. During the last year not an ounce of urine has entered the bladder. Except for the inconvenience of carrying a urinal, the patient would consider himself restored to perfect health.

*Case 2.*—Jewish Hospital, June 28, 1892. J. I., age 28, salesman, of temperate habits, during three years had had frequent attacks of severe pain in the region of right kidney. During the last year these attacks were followed by hematuria. Milder attacks followed each other at intervals of one or two weeks. During the last seizure he was seen by my assistant, Dr. Evans, who pronounced it of unusual severity. Present condition: robust adult, below average height, but very obese. Physical examination negative. Bimanual examination of right kidney very painful. Kidney can not be distinctly palpated. Urine passed in twenty-four hours, forty-five ounces, reddish in color, specific gravity 1026. Microscopic examination showed a few white blood corpuscles, and oxalate of lime crystals. Diagnosis: nephrolithiasis dextra.

Operation June 30, 1892. Oblique incision. Panniculus adiposus very largely developed. Examination of the kidney difficult, owing to enormous development of fat capsule, much of which had to be removed with scissors and forceps. Kidney loosened and drawn into the wound. Palpation and acupuncture negative as to stone. Incision along convexity and digital exploration likewise negative. The hemorrhage during the search having been rather profuse, the kidney wound contused, and the search in the hope of reward having been rather prolonged, the renal wound was partly closed with sutures and a drainage tube carried into the pelvis. Nephrorrhaphy with catgut sutures. Owing to the excision of retro-renal fat masses, the avoidance of a cavity was not practicable. During seventy-two hours the patient suffered excruciatingly from renal pains, which subsided with the removal of the drainage tube. The wound healed by primary union, except for a renal fistula, which healed spontaneously within three months. During six months after operation, patient suffered from no attacks. An opportunity to see him since has not been had.

*Case 3.*—M. C., age 35, seamstress; entered Good Samaritan Hospital Nov. 9, 1892. States that for two years she has been suffering from lumbar pains, followed in the course of time by a constant soreness in the left side. The urine became cloudy, filled, according to her statement, with mucus and pus, and often presenting large quantities of blood. She states that sand was often passed, and in September last she passed a calculus the size of a pea. In urinating, pain is always present, and the stream is suddenly checked. She also states that she sometimes has pain down to the heel of the left foot, and that it is often of a shooting character.

She had hemoptysis and cough three years ago and has frequently suffered from night sweats. Present condition: patient in poor condition, having lost about twenty to twenty-five pounds; appearance somewhat emaciated; urinalysis shows urine to be normal the greater portion of the time, but after sustaining severe pains in the bladder it contains either enough blood to tinge it or to appear in the form of clots on sedimentation. Cystoscopic examination made by a specialist indicated the presence of a neoplasm in the anterior wall of the bladder. Whereas this was far from distinct, the suprapubic incision for exploratory purposes was determined upon.

April 16, suprapubic incision displayed a bladder normal in every regard. No hemorrhage was visible at the examination. The ureters were carefully examined at the time, and nothing in the way of blood was found to come from them. Since the operation was negative in its results, the bladder wound was closed at once by Lembert sutures and the incision through the parietes packed. The wound in the bladder healed by primary intention, temperature and from pulse always remaining normal. Patient was discharged the hospital June 6, 1893, with the wound perfectly healed.

Patient re-entered the hospital March 8, 1894, and complains of severe pain in the region of the left kidney, shooting toward the groin and the leg; is also very tender to pressure over the left kidney; again has blood in the urine at intervals, especially after the pain is severe. March 28. Says that she passed a stone last night while urinating, but it was lost in the closet; no one saw it. The patient insists upon an exploration of the left kidney. April 10. Oblique incision in the left costo-iliac interval; exposure of the left kidney. The kidney was drawn into the wound and carefully palpated with negative results. Incision in the convex surface large enough to admit the finger, with exploration of the calices, likewise negative. The incision was prolonged therefore into both poles and the kidney subjected to ocular inspection. Nothing abnormal was found. The hemorrhage was relatively slight and ceased entirely after the insertion of four deep and five superficial catgut sutures. After the kidney was fixed in its position with silk-worm gut, external wound was closed. By May 1 the patient had recovered without any trouble from the operation, and on June 5 was discharged. There was no further hematuria or pain of any consequence. Four months after the operation the patient presented herself at the office with a needle underneath the skin of Scarpa's triangle on the left side. This was removed, the patient claiming to have no knowledge as to how it came there.

Oct. 8, 1894. Patient visited hospital to-day; is in good health and has had no return of her trouble.



*Case 4.*—Good Samaritan Hospital, Sept. 20, 1894. Mrs. W., age 43, married. About seven years ago patient was sick with acute renal pains, followed by discharge of pus and blood with the urine. Since the first these attacks were invariably limited to the left side. The present attack, like previous ones, began suddenly with the sense of weight and fullness, and the detection of a swelling. Present condition: Fairly nourished woman. Temperature in the morning normal; in the evening 100 degrees; pulse varying between 80 and 100. On the left side, the kidney enlarged to the size of a double fist, can be clearly outlined in its lower segment. It presents itself as a rather movable tumor in the costal-iliac interval, not reaching the iliac crest. Urinalysis: urine often examined is turbid, light in color and containing a sediment rich in pus cells and crystals of oxalate of lime; a few red blood discs in every specimen. Very many examinations failed to reveal the bacillus of tuberculosis. Diagnosis: movable kidney, with recurring pyonephrosis, probably of calculus origin. Right kidney determined to be normal by cystoscopic examination.

Operation, September 28. Chloroform-morphia narcosis. Incision parallel to last rib. Exposure and fixation of kidney. Removal by incision of about a pint of fetid pus. Kidney sacculated. In lower portion an adherent calculus was found and removed with some difficulty. Irrigation and drainage. The patient's temperature varied from 101 to 102.5 degrees from the third day for a week. Profuse discharge necessitated daily dressing.

November 27. Patient discharged in good condition, with renal fistula and drainage tube.

Since the operation I have seen the patient once for renal distension, from displacement of tube. Nephrectomy will eventually become necessary.

The presence of an oxalate of lime calculus (weight 17 grains), with the history, makes it probable that nephrolithiasis was the first condition, followed by recurrent hydronephrosis and in turn by mobility of the kidney. Suppuration was probably a late factor in the case, which earlier interference would have prevented.

*Case 5.*—L. S., male, age 25, admitted to Avondale Hospital with diagnosis of recurrent appendicitis. States that except for hip disease, from which he suffered early in life, he was well until eight months prior to admission, when he was suddenly seized with severe colicky pain in region of appendix, associated with vomiting. Was free of pain for six weeks, when he suffered a second attack of great severity,



which confined him to his bed during four weeks. He has never recovered entirely from this attack. States that he is always in pain, for which he has habituated himself to the use of morphia, of which he takes about three-quarters of a grain in the twenty-four hours. Present condition: well developed male. Ankylosis of right hip and complemental pelvic inclination. Complexion rather sallow. Pain more or less constant in the region of the appendix. Three times within the month the pain was severe enough to require the administration of morphia by injection. During these attacks the temperature rose to 100 degrees; at other times normal. Careful palpation fails to reveal tenderness over the appendix. Physical examination of the abdomen negative. Pressure over the last rib toward the kidney always elicited severe pain. Urinalysis: during six weeks, urinalysis made twice each week. Urine always contained in the neighborhood of .5 per cent. of albumin. It was generally light straw color, slightly turbid, always acid. Microscopic examination always revealed pus cells and a few red blood corpuscles, and bladder epithelia. Crystals were never found. Repeated examination by centrifugation failed to reveal tubercle bacilli, the presence of which would not have been surprising with the previous history of long-standing tubercular disease of the hip.

November 4. Cystoscopic examination under cocain. Bladder normal; stream from right ureter was turbid; across the field slight flakes of white material passed from time to time. The left ureter discharges clear urine. Diagnosis: nephrolithiasis dextra.

Operation November 11. Oblique incision through the right costo-iliac interval. Exposure of the kidney, which seems normal in color and size. In the posterior wall, near the hilum, an induration distinctly palpable. Acupuncture proves it to be due to a stone. Radial incision in the line of the blood supply, followed by the easy removal of a stone, uric acid, weight 60 grains. The stone was in the substance of the gland, only slightly projecting into the pelvis. The wound in the kidney was closed by three catgut sutures. Palpation of the kidney for other stones negative. Fixation of the kidney by two silkworm gut sutures. Drainage with strands of silkworm gut.

November 12. Patient passed a restless night. Severe pain in the back, right groin and testicle. Urine very bloody and containing many clots. Quantity passed in twenty-four hours, thirty ounces. Temperature 100 degrees; pulse, 90.

November 13. Pain less severe. Passed forty ounces of urine; last samples slightly tinged with blood. Temperature normal; pulse normal.

From this time the patient's recovery was uninterrupted. The drainage was removed with the first dressing, on the tenth day. Union perfect. December 4. Patient discharged well. April 4. Patient presented himself to-day, perfectly restored to health. The urine normal in every respect.

*Case 6.*—Martin L., aged 28, single. Entered Good Samaritan Hospital Feb. 26, 1894. History for the past five years: has had severe pains in the region of the left kidney. Very frequently he has suffered from severe pains shooting down the groin and the left testicle and into the leg. These attacks are usually followed by the appearance of blood in larger and smaller quantity in the urine. These attacks last from one to three days. Present condition: well-nourished man of short stature. Pressure over the left last rib very painful. No enlargement of the kidney discernible. Urinates three to four times during the night. The urine turbid, specific gravity 1040, rich in albumin and red blood corpuscles. Contains also oxalate of lime crystals.

March 3. The patient just passed a very bad night, has suffered intensely from an attack of renal colic. Urine passed frequently and containing large quantities of blood. Morphia administered in grs.  $\frac{1}{4}$  doses at 3 in the morning and again at 9. Diagnosis: renal calculus.

March 10, operation. Oblique incision over the left kidney from the middle of the last rib toward crest of ilium. Kidney exposed and brought into the wound. In the pelvis of the kidney a number of loose calculi were felt. Incision one inch long through convex border, circulation being controlled by the finger of an assistant. Hemorrhage slight, but drainage of a considerable quantity of urine. Three stones were easily removed from the pelvis. Two smaller ones adherent to the calices removed by blunt curette. Suture of the kidney wound by three deep and two superficial catgut sutures and sewing of the kidney to the deep fascia. For purpose of drainage, there having been considerable oozing from the peri-renal tissue, the wound was very firmly packed with gauze. March 11. Patient passed a very bad night, vomited considerably and complained of some abdominal pain. Passed from the bladder ten ounces of bloody urine. Ordered a teaspoonful of Epsom salts every two hours. Dressings changed and gauze removed. No drainage of urine from the wound. Wound looks healthy. March 12. Evidences of intestinal obstruction, vomiting recurring at intervals of half an hour has assumed the form of regurgitation. Bowels have not moved. Abdominal distension very marked. Temperature 100; pulse between 120 and 130; quantity of urine in twenty-four



hours, twenty-seven ounces. March 13. Patient passed a very bad night. Regurgitation more marked. Temperature 96; pulse 160; 11:30 p.m., patient died.

March 14. Autopsy. Abdomen very much distended. Upon opening the abdomen the intestines, from the descending colon upward, including all of the small intestine to the duodenum, very much distended; peritoneal vessels, mesenteric and intestinal, are very much injected. There is no pus present, nor are there any flocculi of lymph to be found. Very thorough search of the peritoneum over the kidney fails to reveal any wound of this tunic. Left kidney presents a wound along its convex border quite firmly agglutinated. About the incision some infiltration of blood in the cortex of the kidney. Right kidney normal.

*Case 7.*—D. K. G., male, age 47; observed with Dr. Forchheimer. Family history good; has never been seriously ill, except three years before he came under observation, when he was confined to his bed with severe pain in the left lumbar and inguinal regions, which was ascribed to ileo-colitis. Within the last year he has suffered a number of times from chills followed by febrile elevations. These seizures would keep him indoors for twenty-four or forty-eight hours only. During these attacks he would frequently vomit. He has not lost in weight. His greatest complaint has been pain in the back, which would awaken him in the night. The pain has never been severe enough to necessitate the use of morphia. It has been limited to the left side, and never assumed the form of renal colic. Has twice been examined for bladder trouble and each examination was followed within an hour by a rise of temperature to 104 degrees. Within twenty-four hours the temperature subsided to the normal. This patient was under my observation during six months. He was enabled to follow his vocation, and except for pains at night, and what he believed to be malarial seizures, suffered comparatively little. On the part of the urinary tract there were no subjective symptoms. Micturition was neither abnormally frequent nor painful at any time. Physical examination negative, except for a very marked tenderness over the left kidney, which could always be evoked by deep pressure against the last rib. Bimanual examination failed to reveal any enlargement of the kidney, nor were referred pains ever elicited. Urinalysis. During six months his urine was examined at least once a week. It was always slightly turbid when passed, a little paler than

normal, acid in reaction and of normal specific gravity. Every specimen contained a trace of albumin, a number of pus cells and a few red blood discs. At no time during the prolonged period of observation did the specimens obtained by centrifugation contain either crystals or tubercle bacilli. During the last month prior to operation, the pyuria increased notably.

November 25. Cystoscopic examination under cocain. Bladder normal. Ureters brought into view, and streams of urine found alike on the two sides. About the left ureteral orifice, there was an area of redness, extending apparently a half inch toward the urethra. Hemorrhage was not observed. The examination, though made with every precaution to the contrary, was followed within two hours by a chill and a rise of temperature to 104 degrees. In three days the patient was again about his work. Diagnosis: nephrolithiasis sinistra.

Operation, at Christ Hospital, Jan. 22, 1895. Morphia and chloroform anesthesia. Oblique incision through costo-iliac interval. Exposure of kidney through *capsula adiposa* of moderate thickness. Kidney, apparently of abnormal length, drawn into the wound and carefully palpated with negative results. Acupuncture resorted to without locating a stone. With digital compression of the renal pedicle, the autopsy cut was made and the interior of the gland subjected to palpation and inspection. The incision was attended by very little hemorrhage; nor was any pus evacuated. The kidney structure was normal. In the lowermost portion of the pelvis an elongated stone was found, opposite the beginning of the ureter. An effort to remove it through the incision in the kidney failed. Therefore the pelvis was opened by a longitudinal incision. The stone was easily removed. Wound in pelvis closed by two catgut Lembert sutures. For the closure of the kidney wound, three deep and four superficial sutures were used. After fixation of the kidney with silkworm gut sutures, the wound was closed, a strand of gut being used for drainage. An uninterrupted recovery followed the operation. During seventy-two hours the urine contained considerable blood, and the colicky pains were severe enough to necessitate the use of morphia. Hemorrhage from the kidney ceased on the third day. The highest temperature reached was 100 degrees. The quantity of urine was twelve and one-half ounces the first twenty-four hours; twenty-one ounces during the second; thirty-seven ounces during the third, after which the quantity was normal. The patient has had no attack of pain since the operation. The urine still contains a few pus corpuscles, but red blood discs are not to be found. First dressing and drainage was removed on the tenth day; sutures at the end of two weeks. Primary union along the entire line. The



patient left the hospital after five weeks, well, except for the presence of pus cells in the urine. In four examinations made since his departure from the hospital, blood discs were not found. In two examinations of urine recently made, oxalate of lime crystals were found.

Stone in the kidney is far from being a rare affection, if the records of autopsies are to be judged from. In the majority of cases thus found, they were unattended by tangible symptoms. On the other hand, no other affection of the kidney is so often erroneously supposed to be present as stone. Of the seven nephrotomies here recorded and made for stone, the search proved fruitless in two. In 1886 Gross<sup>1</sup> was already enabled to collect twenty-nine cases of unsuccessful operations for stone, all of which recovered. A few years later McCosh<sup>2</sup> found five additional cases of which two were fatal. These were cases of Chavasse,<sup>3</sup> and in both calculi were found at the autopsy. Similar unfruitful explorations have since been made, twice by Keyes<sup>4</sup> and Parkes,<sup>5</sup> once by Guyon,<sup>6</sup> Bruce Clark,<sup>7</sup> Tiffany<sup>8</sup> and Israel<sup>9</sup>. While it is probable that in some of these cases a small concretion was overlooked, the thorough exploration after incision made by such competent operators must lead us to believe that there is a condition of the kidneys, other than lithiasis, which is expressed by the symptomatic tripod of renal calculus before destructive changes have been produced, namely, lumbar pains, renal colic and hematuria. The term "nephralgie hematurique," proposed by Sabatier<sup>10</sup>, describes the cardinal symptoms but does not explain the condition which varies with the varying causes of hyperacidity of the urine, syphilitic cicatrices, mobility of the kidney and consequent intermittent hydronephrosis or hemophilia with renal expression of its presence. In a nephrectomy done for hematuria by Senator,<sup>11</sup> the kidney was found absolutely normal. For diagnostic purposes, catheterization of the left ureter was made by Nitze through a suprapubic incision, and the source

of the hematuria, if not its cause, satisfactorily determined. In one of my own cases, although the kidney was not removed, the hematuria was doubtless of like hemaphilic origin, for the kidney upon section was found absolutely normal. (Case 3.)

An array of forty-four recorded cases of failure to find a stone may be of importance in damage suits arising from such failure. They demonstrate that the diagnosis can be only approximately made. The record is equally significant in showing the safety of such explorations since only two deaths are recorded, and in both cases stones were found at the autopsy. It is equally noteworthy that in many of the cases thus operated upon, permanent relief was afforded by the exploratory incision, either in consequence of section of the lumbar nerves or of relief of intra-capsular tension, the severance of adhesions or the fixation of a previously movable kidney. In not a few, however, has there been recurrence of symptoms in from a few weeks to a year.

In the diagnosis of kidney stone, writers have for many years pointed to the presence of abnormal constituents in the urine. First, crystals indicative of the character of the stone; and second, blood in quantities appreciable to the unaided eye. The hemorrhage, it is said, is rarely as profuse as in malignant disease, but yet is present in considerable quantity. In both regards, observations often and carefully made will be negative. In two of the cases very accurate examinations for a period of from one to six months were made and crystals were not found. Except when a stone is in the process of growth, the presence of crystals can hardly be expected. Furthermore, to be of clinical significance, the crystals must be proved to be passed with the urine, and not to have been formed later. In only one of the cases of successful nephrotomy for stone recorded above, was the hematuria apparent. Far more important, however, it appears to me, is the presence of red blood discs at every microscopic examination made.



In three of the cases the examination extended over a period of from one to six months, without out failure to find a few discs in every specimen examined. In all of these cases the microscopic hematuria was associated with acid pyuria. The aseptic character of the latter in two of the cases was repeatedly demonstrated by centrifuging. Mechanical irritation, pressure, necrosis of the renal epithelium and minimal erosions of capillaries produced by a renal calculus accounted for the slight hematuria and the pyuria, aseptic in its character.

This does not accord altogether with the views, particularly of the French school, as expressed by Tuffier regarding the ability of the kidneys to entertain without any reaction, aseptic bodies of even large size, and that when septic infection does ensue, it is the result of upward extension of like processes from bladder and urethra, either from a gonorrhea, or unclean catheterization. Large and small stones by their presence produce pressure, atrophy and cirrhosis. In the specimens here presented, of two kidneys in which large primary calculi are found, the area of atrophy will be seen just a little larger than the measurements of the concretions, which by pressure on the vessels had induced an aseptic infarct and secondary atrophy of the contiguous kidney tissue. The kidneys, as a whole, present the picture of interstitial nephritis. Although growing into the ureters and filling the pelvis, the stones have produced no destruction of either. Yet the inspection of these kidneys assures us that had pleuro-pneumonia not claimed the individual, death must have resulted soon from renal changes which, slow, mechanical and aseptic, were none the less destructive to the secreting elements. Regarding the history of this case, nothing is known, although it is almost inconceivable that an examination of the urine would have failed to detect evidence of renal disease.

Regarding the channels of septic invasion in renal lithiasis, it appears to be far from certain that the

usual route is from below upward, as it doubtless is in the typical surgical kidney developing in the course of primary lesions of the lower urinary tract. In two of the recorded cases there never had been a gonorrhea. In three of them, instrumentation of the bladder had not been practiced until after the discovery of the pyuria. Posner and Lewin<sup>12</sup> have recently made very interesting experimental observations which establish the auto-infective nature of many suppurative processes of the urinary passages, and which throw much light upon the cause of supuration in cases of stone in the kidney where instrumentation had not been practiced. The source of infection is the intestinal canal and the channel the general circulation. The eliminative function of the kidney has been shown for other infectious diseases. In the case of suppurative processes, thus produced experimentally by ligating the ureters and obstructing the intestine, the bacillus found in the kidney was almost always the gas-forming organism belonging to the bacterium coli group. Pyuria from stone may, therefore, be aseptic; or, if septic, be the result of infection from the lower urinary tract, or caused by the eliminative function of the kidney.

The value of cystoscopic examination, as an auxiliary to the diagnosis of renal calculus can not be questioned. The presence of two discharging ureteral mouths assures us better than any other method can, of the presence of two active kidneys. It can not exclude the possible existence of a horse-shoe or placental kidney with double ureters. The certainty of the non-existence of vesical disease, as established by the cystoscope of Nitze or of Kelly, often makes it certain that the symptoms in a given case are of renal origin. In two of the three cases in which it was used, the information was of absolute value in excluding the bladder as the source of the disease and fixing the site of the latter. In one of the cases a turbid stream with a few flocculi was ejected from the right ureteral cone, while the urine from the left

side was very clear. In a second case the left ureteral mouth presented an irritated appearance entirely at variance with the picture of the right side. In the third case, one of profuse hematuria, cystoscopic examinations were entirely negative. With a wider knowledge of direct catheterization of the ureters, as practiced by Pawlik, and of the better method of direct illumination of the bladder, as practiced by Kelly, the elucidation of obscure renal disease will doubtless be made comparatively easy. In the male it may be justifiable to resort to suprapubic incision and direct catheterization of the ureters for diagnostic purpose. Quite recently, Nitze has added the ureteral catheter to his cystoscope. It is not probable that many will become experts in its use. Unfortunately, the cystoscope is of no value in cases where it would be most needed; those in which there is an *indicato vitalis* for operative interference, particularly on account of hematuria and anuria.

Anuria is by far the most interesting, as it is also the most fatal, complication of kidney stone. Of fifty-six cases collected by Legueu,<sup>13</sup> treated conservatively, sixteen recovered in from three to twenty days; forty or 71.5 per cent., died in from four to twenty-five days. Autopsies were made in thirty cases. In twenty-three, the ureter was found blocked by a stone, while in seven a gross mechanical obstruction was not present. In three cases there was only one kidney. In six, both ureters were blocked by a calculus. In fourteen additional cases, both kidneys contained stones. In six, there were other evidences of disease, chiefly suppuration, and in one case the kidney was normal. In sixteen cases of anuria, nephrotomy was followed by recovery in ten, the mortality being 37 per cent., as against 71.5 per cent., in cases left to nature. Such statistics justify the division of nephro-lithotomies into those of choice and those of necessity. The conditions may well be likened to those of hernia. In the unobstructed, we may choose the time for operative interference; in



the strangulated, delay means death. Anuria in calculus disease may be the result of a simultaneous obstruction of both ureters, a condition which is quite unusual. It generally depends upon obstruction of the ureter of one kidney, and reflex arrestation of function of its fellow, which in the majority of cases is likewise found to be diseased. That primary anuria or oliguria may be the result of inhibition of a normal kidney through reflex channels from obstruction in its diseased fellow, or after nephrectomy, has been positively settled by experimental as well as by clinical observations. Among the most striking of the latter was one made by Israel<sup>14</sup> in a case of hydronephrosis of intermittent type. With each recurrence of increased intra-renal tension in the diseased kidney, the secretion of normal urine was reduced to a minimum. Tapping of the hydronephrotic side was immediately followed by the flow of the normal amount of urine from the healthy kidney. Pressure upon the kidney tissue or irritation by packing or ligation of the pedicle after nephrectomy, may bring about the same reflex diminution of function of the remaining gland.

Death follows nephrectomy from uremia in nearly 50 per cent. of cases, (Madelung<sup>15</sup> eight out of seventeen). In most of these it has been presumed that there existed but one kidney. For such cases in the future it will be obligatory to explore the side not previously operated upon, and if a kidney be found, to make an exploratory incision. It is more than probable that the sudden increase in function of the remaining gland is associated with a degree of hyperemia incompatible with excretion from the glomeruli, for which the local depletion of nephrotomy could only be of benefit.

Since Bardenheuer's<sup>16</sup> case of nephrotomy for anuria after operation on one kidney was published in 1882, a number of most brilliant successes have been recorded by Lange,<sup>17</sup> Clement Lucas,<sup>18</sup> Meyer,<sup>19</sup> Kirkham,<sup>20</sup> Godley,<sup>21</sup> Israel<sup>22</sup> and Cabot<sup>23</sup>. In most

cases, as in my own, the operator was relieved of the difficulty of determining the side for operation by the previous clinical history, the limitation of pain to one side, by the presence of tenderness or tumor, or by the previous removal of one kidney. Except for the certainty give by the condition last named, there must always be some doubt as to the side to be operated upon. In a case of anuria, Israel operated on a hydronephrotic left kidney. The patient was not relieved. Twenty-four hours later the right kidney was explored and a stone located in the ureter too low for removal at the time. The patient did not rally, the anuria having continued nine days. Tuffier has properly pointed out that operation should not be deferred on account of doubt as to the side of obstruction, since the chances are always 50 per cent. that the diseased kidney will be found, and it might be added, if the chance fails an immediate exploration of the opposite side should be made. I have been enabled to find only one case of simultaneous bilateral nephrotomy for calculus anuria. The patient died eleven days after the operation.<sup>24</sup>

In the surgical treatment of renal calculus, choice must be made between simple incision and extirpation or partial resection of the kidney. The localized conditions demanding the latter must of necessity be so rare that for present considerations they may be disregarded. Nor would any one resort to the more drastic operation with a comparatively normal condition of the kidney and a small calculus. It is in the presence of multiple or of large branched calculi and of a kidney more or less converted into an abscess cavity that the question becomes embarrassing. Neither the size, conformation nor multiplicity of the calculus ought to weigh in favor of nephrectomy, since with the longitudinal incision along the renal convexity, ample room for manipulation can be obtained. Nor does the dread of a renal fistula remaining after nephrotomy for calculous pyonephrosis render nephrectomy justifiable, except when cysto-

scopic examination or the voidance of clean urine renders unimpeachable evidence of the presence of a normal kidney; for in seventy-six fatal cases of renal calculus, Legueu found the disease bilateral in thirty-eight and in only four instances was the remaining kidney normal. Edel,<sup>25</sup> Clement Lucas,<sup>26</sup> Shepherd<sup>27</sup> reported cases where nephrectomy was followed after four and five respectively, by fatal calculous pyelitis of the remaining kidney. These considerations are weighty, irrespective of the inherent dangers of the two procedures, nephrotomy and nephrectomy, the mortality of which is decidedly in favor of nephrotomy (nephrotomy 31 per cent., nephrectomy 41 per cent).

With increasing confidence in the relative safety of exploratory nephrotomy, cases of renal calculus will doubtless be earlier subjected to operation and before those destructive changes have ensued which, at the time of operation, force upon surgeons the choice between incision and excision of the kidney. With proper care regarding hemorrhage and sepsis, a nephrolithotomy on an otherwise healthy kidney ought to be attended by a mortality of not more than 5 per cent. The unequalled tabulation of Newman, in 1888, of forty-two cases without a death, could not be maintained. Tait lost one case out of fourteen. Within the last three years, deaths have occurred in the hands of such expert operators as Butler-Smythe, Jacobson, Knowsley Thornton, Godlee and Israel. The immediate mortality of nephrotomy for calculus pyelitis is 33 per cent. A stronger plea than these statistics could not be made for an early operation in real or supposed cases of renal calculus.

In the technique of the nephrotomies above recorded, I have had an opportunity of comparing the relative values of the oblique and the transverse incisions. The advantages of the former have been so decided that I have used it to the exclusion of the other in all of my recent operations on the kidney from the loin. Through an ample incision from the



middle of the last rib toward the iliac crest, the entire kidney can be drawn into the wound, the pelvis, both surfaces and poles, explored by the finger, and the circulation through it absolutely controlled. By continuing the incision downward and forward, all of the suprapelvic portion of the ureter can be brought into view and, if need be, subjected to operative treatment.

The renal calculi which I have presented are all small, the heaviest weighing sixty grains. In this regard the collection may be interesting, since in all of the cases of which they are the trophies, except one, the exploratory needle was used and without any results. In none of my cases was the detection of the stone accomplished by using the needle. A stone weighing 556 grains, as removed by Tiffany,<sup>28</sup> or one weighing nearly five ounces, as removed by Shepherd,<sup>29</sup> and another by Gay,<sup>30</sup> can easily be felt through a puncture with a needle. Here acupuncture is superfluous, since such stones can be felt through the hardened kidney substance by the examining finger. For the detection of small stones a success from acupuncture would be a matter of chance, and therefore, in my judgment, should be discontinued as wasteful of time and fraught with the danger of wounding a larger branch of the renal vessels. Palpation of the kidney drawn well into the wound between the thumb and finger on opposite surfaces, will reduce the danger of overlooking a calculus to a minimum. In this manner all of the kidney, except possibly the superior pole on the left side, can be thoroughly felt. If the calculus even then escapes detection it must be small indeed, deeply imbedded, and discoverable only by incision into the kidney substance.

How and where shall this incision be made? In answering this question two considerations must guide us: hemorrhage and the final result as to a cure without a renal fistula. Hyrtl<sup>31</sup>, as long ago as 1869, demonstrated by corrosive preparations that

the kidney is naturally divisible into anterior and posterior segments, the blood supply of each being independent of that of the other, after the vessels supplying them have been given off from the main trunk of the renal artery. Along the convexity of the gland, therefore, the longitudinal section made as in an autopsy would be least likely to wound a larger vessel. In four operations in which I have resorted to this sectional incision the hemorrhage, while free, was parenchymatous in all. To reduce even this to a minimum the incision should not be made longer than is needful for the introduction of the exploring finger, until the kidney has been brought far enough into the wound to make feasible the compression of its pedicle by padded clamp, or preferably by the fingers of an assistant. This makes the hemorrhage *nil*, while the search for the stone progresses. Such compression has been experimentally maintained for half an hour (Tuffier) in animals without other effect than a transitory albuminuria. In an operation for stone, compression would rarely be needed during more than five minutes. The length of the incision must vary with the difficulties encountered in searching for and removing the stone. With a finger introduced into a kidney through a small incision in the center of its convexity, or two incisions nearer the poles, the separate calices can be as methodically explored as are the fingers of a glove. Only after failure of this method to find a stone does the complete division of the kidney from end to end, for ocular inspection, as in a post-mortem examination seem justifiable. Incisions into the renal pelvis for exploration alone are to be avoided because of the obviously greater danger of hemorrhage and the dread of lacerating the pelvic wall beyond repair.

Renal fistulæ are seen oftener after incisions into the pelvis than after nephrotomy proper, the ratio being as 20 to 3. Therefore, stones found in the pelvis of the kidney should, wherever possible, be removed through an incision in the cortex. In one of my cases

a stone was found embedded near the posterior surface. In such a case a radial incision on to the stone, passing between the blood vessels, is ample for its removal and not attended by severe hemorrhage.

For operative wounds of the kidney, primary union should be aimed for, as scrupulously as in wounds elsewhere. Drainage of the kidney is therefore uncalled for except for pyonephrosis, where the ureter is manifestly incompetent. In one of my cases the presence of a drainage tube gave rise during seventy-two hours to very severe pain, and was the direct cause of a fistula which continued to discharge during three months before it finally closed. In nephrolithotomy on an otherwise normal kidney, the ideal operation is terminated by closely suturing the wound in the kidney with alternate deep and superficial catgut sutures, traction on which should only be sufficient to keep the edges in apposition. Experimentally and clinically, such sutures have been shown to be practically innocuous to the kidney at large, and that the resulting scar involves only the immediate vicinity of the line of incision and of the sutures, provided larger vessels are not included. Experiments by Paoli,<sup>32</sup> Tuffier<sup>33</sup> and Barth<sup>35</sup> have shown that, particularly in the incision along the convexity, secondary degenerative changes are reduced to a minimum. Griefenhagen<sup>35</sup> had an opportunity to examine two kidneys treated by sutures after operation. A linear and depressed cicatrix narrowing toward the pelvis and firmly adherent to the capsule was present in each kidney as the only vestige of a previous incision. One patient died of apoplexy six months after the operation. In the other, the kidney had become movable and at times incarcerated in a ventral hernia making nephrectomy necessary. Suture of the kidney first practiced by LeDentu,<sup>36</sup> in 1889, has been performed successfully by Morris, Israel, Fenger, Bernays, Tuffier, Garard, Marchant and Rose.

Primary union should likewise be sought for when the pelvis or ureter has been incised; catgut Lembert



suturing being used. The probability of success is less than in nephrotomy proper. In one of my cases thus treated the result was perfect. Meyer and Sanger have recently reported similar successes. A slight objection to primary suture is the severe pain of a colicky nature entailed by the passage of small blood clots through the ureters and lasting from twenty-four to forty-eight hours.

The only fatal result which I have had to record from my nephrotomies for stone was directly attributable to intestinal obstruction from excessive packing of the wound with gauze. This obstruction was the result of paralysis from pressure on the intestinal nerves in their course in the meso-colon and behind the posterior parietal layer of the peritoneum. This is the second case of this nature to be recorded; the other occurred in the hands of Israel. There probably have been other deaths erroneously ascribed to peritonitis after operation on the kidney and in which wounding and infection of the peritoneum have been supposed to be the causes of death. In two of the cases operated on since this unfortunate result, I have contented myself with such drainage as could be obtained by a strand of silkworm gut removed with the first dressing.

The concluding act of every operation upon the kidney must look toward fixation of the gland in its normal position. Where the fat capsule has not been interfered with much and the kidney has been little disturbed in its relations in the process of searching for and removing the stone, nature can be relied upon to secure its proper fixation. In every case, however, in which the gland has been removed from its bed and drawn into the wound, either for purposes of exploration or operation, a *sine qua non* of an undisturbed and lasting recovery is the fixation of the kidney in its position by a number of catgut or, preferably, of silkworm sutures. A number of recent writers have suggested that the sutures used for closing the renal incision can likewise be employed for

the fixation of the gland. My own preference has been for the silkworm gut. By two sutures through the kidney, the capsule proper, and the fat capsule on the one hand, and the lumbar fascia and the peritoneum of the last rib on the other, the kidney can be firmly and satisfactorily anchored until such time as post-operative adhesions result. One of the safeguards against mobility of a kidney is, in my judgment, prolonged rest in bed of at least five to six weeks before the patient resumes the erect posture. In the triumph of finding a stone, the precautions against a movable kidney might readily be overlooked. The danger of allowing the gland to take care of itself has been shown in a number of cases, and notably in the one of Griefenhagen already referred to, where secondary nephrectomy became necessary.

In conclusion, the following theses are presented for your consideration:

1. An absolute diagnosis of stone can not be made.
2. Nephro-lithotomies may be divided into those of necessity and those of choice. In anuria and profuse hematuria delay is fatal.
3. Pyuria and microscopic hematuria as indications of beginning destructive changes, are positive indications for operative exploration.
4. The oblique incision is to be preferred for the ease with which it permits the exploration of the entire kidney.
5. Acupuncture is not to be relied upon.
6. Incisions should be made along the convex border and only when the circulation is controlled by digital compression.
7. Incisions into the pelvis for exploration and for removing a stone are to be avoided.
8. Primary nephrectomy for stone should be reserved for extreme cases.
9. Primary union by suture, where feasible, makes nephro-lithotomy an ideal operation.
10. Tight packing of the kidney wound and perirenal space endangers the nerve supply of the colon.

11. Nephrorrhaphy should form the closing act of every operation which has seriously disturbed the relations of the kidney.

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